

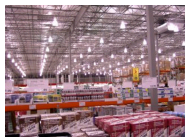
# MATERIALS

## Challenge

The large volume of products used at Fort Carson is the result of ingrained practices and habits relating to purchasing and use. Disposal of solid and hazardous materials is getting more expensive. The purchase and use of products add to environmental degradation through harvesting of natural resources, manufacturing, transportation emissions, and disposal. How can the Installation use less, purchase less, substitute more environmentally friendly products, and enhance recycling efforts while still maintaining the core mission of Fort Carson?

## Key Considerations

- **Clean Products** – The use of materials that are nontoxic, made of renewable resources, produced in an environmentally friendly manner, and easily reused or recycled is critical to sustainability.
- **Product Leasing** – Fort Carson purchases many products such as carpeting, furniture, and appliances. Little or no consideration is given to what will happen to the product when it no longer meets its intended use. Companies now offer leasing of products where the supplier will take away and reuse/recycle the product when the user is finished with it.
- **Local Manufacture** – The purchase of locally manufactured products stimulates the regional economy, reduces transportation costs and environmental impacts, and helps sustain the community. In addition, the use of local manufacturers may increase the feasibility of creative product use approaches, such as product leasing or manufacturer buy-back in which the manufacturer buys back all of, or components of, the original product.
- **Use Reduction** – Sustainability depends on the ability to use the smallest quantities of products and materials needed to meet minimum requirements—in other words, not wasting resources. This includes reducing amounts used, spilled, and leaked to the environment.
- **Reuse and Recycling** – Material reuse and recycling reduces the costs and environmental impacts associated with processing virgin materials, transporting new products, and use/disposal of waste materials.



## Importance to Fort Carson

**Mission** – The management of products, materials, and wastes requires many person-years of labor and represents a significant portion of the operating budget of Fort Carson. Additionally, the proper management of hazardous materials and wastes requires soldier time that could otherwise be spent on mission-related tasks.

**Quality of Life** – The use of hazardous materials can affect the health and safety of Fort Carson's soldiers, families, and workers. The release of hazardous materials and waste and the disposal of solid waste can contaminate air and water.

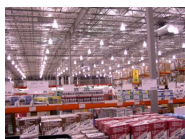
### Costs for 2001

- New products and materials: Fort Carson purchased \$110M
- Garbage disposal: \$386,681
- Construction and demolition (C&D) debris management and disposal costs: \$66,786
- Hazardous waste disposal costs: \$60,000
- Hazardous Material Control Center (HMCC) operating cost: approximately \$300,000 per year (actual costs are contractual and not for public dissemination)
- Treatment, Storage, and Disposal Facility (TSDF) permitting and Resource Conservation and Recovery Act (RCRA) compliance program cost: \$20,000/yr
- Defense Reutilization and Marketing Office (DRMO) and reuse cost avoidances for hazardous materials: \$222,000
- Landfill closure costs: \$6M

**Environment and the Community** – Fort Carson has the potential to stimulate local economic growth by using local manufacturers and producers. Environmentally friendly purchasing could support community sustainability while improving the quality of life for the community and its resident soldiers.

While the Hazardous Materials Control Center has inducted nearly all applicable units and directorates on the Installation, it does not proactively service these units with visits and scheduled hazardous materials inventories. This reduces the amount of hazardous material that can be effectively tracked and managed. Therefore, while Fort Carson initially characterized, tracked, and modified its material purchasing to reduce environmental impacts, it is unknown whether stockpiling of hazardous materials and bypassing of the Hazardous Materials Control Center has occurred. The Hazardous Waste Compliance Assistance team does not work with the Hazardous Materials Control Center technicians to know whether the material they find is in excess of authorized use for the owners of the material; thus, they cannot tell if the material they find during an inspection is authorized or excess. The HMCC does conduct research to find less hazardous substitutes for materials used at the Installation.

Solid waste is currently shipped 15 miles to the Midway Landfill for disposal. With the closing of landfills at the Installation, costs to transport and dispose of solid waste will increase dramatically in the future.



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## Introduction

Fort Carson spends over \$110 million/year in material purchases. Any large military installation makes significant purchases of many types of materials. For example, vehicle maintenance and repair use certain hazardous materials. The Federal government is the largest purchaser of materials in the country, and as such, has considerable influence on product development and the materials that go into products. This section addresses hazardous materials, nonhazardous materials, and procurement practices, which relate to recycling, waste prevention, and use reduction, all of which have economic impacts. In addition, purchasing decisions have other indirect impacts relating to the environment and to the well-being of society as a whole and individuals within the society.

## Background

The purchase and use of products and materials creates some of the most significant impacts on the environment. The extraction and processing of raw materials, use of energy in manufacturing, transport of finished products, and ultimate use and disposal of these products present a great challenge to the sustainability of the operation purchasing the products and materials.

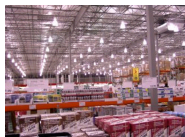
Construction and demolition debris and contaminated soils and sediments constitute by far the largest proportion of the solid waste stream at Fort Carson. These materials were disposed of on site until the landfill was closed on April 1, 2002. The remainder of the solid waste stream, household garbage, office waste, and cafeteria waste is shipped off site for disposal. Figure 6.1 summarizes solid waste amounts and disposal costs.

**Figure 6.1– Fort Carson Solid Waste**

Waste Stream	Amount Generated in 2001	Collection and Disposal Costs
Construction and demolition waste, Contaminated soils and sediments	297,867 tons	\$66,786
Household, office, and cafeteria	8,935 tons	\$386,681
Total	306,802 tons	\$453,467

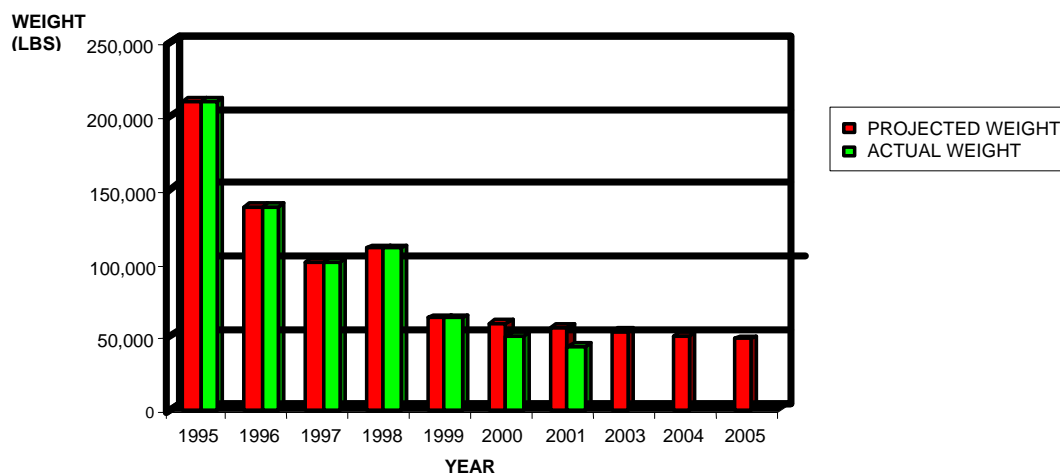
As Figure 6.1 indicates, only three percent of the solid waste stream was managed off site in 2001, at a cost of \$386,681. If all waste generated during 2001 had been disposed of off site, the cost would have been nearly \$3.4 million! Fort Carson no longer has use of an on-site landfill. Therefore, if extensive recycling and waste reduction measures are not implemented, costs for solid waste disposal at the Installation will increase significantly.

Hazardous waste disposal at the Installation has decreased dramatically since 1995 (Figure 6.2). This decrease is due in large part to the excellent Environmental Compliance Assistance Program and Pollution Prevention Projects such as the Hazardous Materials Control Center (HMCC). In 2001, 49,000 pounds (24.5 tons) of hazardous waste were disposed of through the Fort Carson hazardous materials staging and shipping site.



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**Figure 6.2 – Fort Carson Annual Hazardous Waste Disposal**

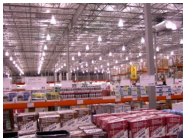


The decision to purchase a specific item drives the future costs of using, managing, and disposing of the product. Manufacturing, transportation, storage, and use of products and materials cause negative environmental impacts both on and off post. Costs and environmental impacts associated with waste disposal include air and water contamination and undesirable land use.

The federal government is committed to encouraging markets for environmentally preferable products, (EPPs)—products that contain or require less hazardous materials to produce or use, have fewer environmental impacts compared to similar products, and/or contain recycled materials. To that end, all federal installations are required to purchase EPPs such as recycled paper, re-refined oil, and retread tires. (A list of EPPs can be found at <http://www.epa.gov/cpg/products.htm>.) The General Services Administration Environmental Products and Services Guide provides a list of EPPs on <http://www.gsa.gov> (click “Buying through GSA” then “Environmental Products and Services”). Currently, there is no central monitoring or tracking of compliance with the EPP requirements at Fort Carson.

New construction contracts include a clause concerning the use of recycled materials. Also, the Directorate of Contracting is working to establish an Affirmative Procurement Program, which sets policy and steers future purchases in the direction of more environmentally friendly products. The first step in this process is the “Policy Plan,” which is being developed by the Directorate of Contracting with input and commitment from all other Directorates. The Policy Plan should be complete in 2002.



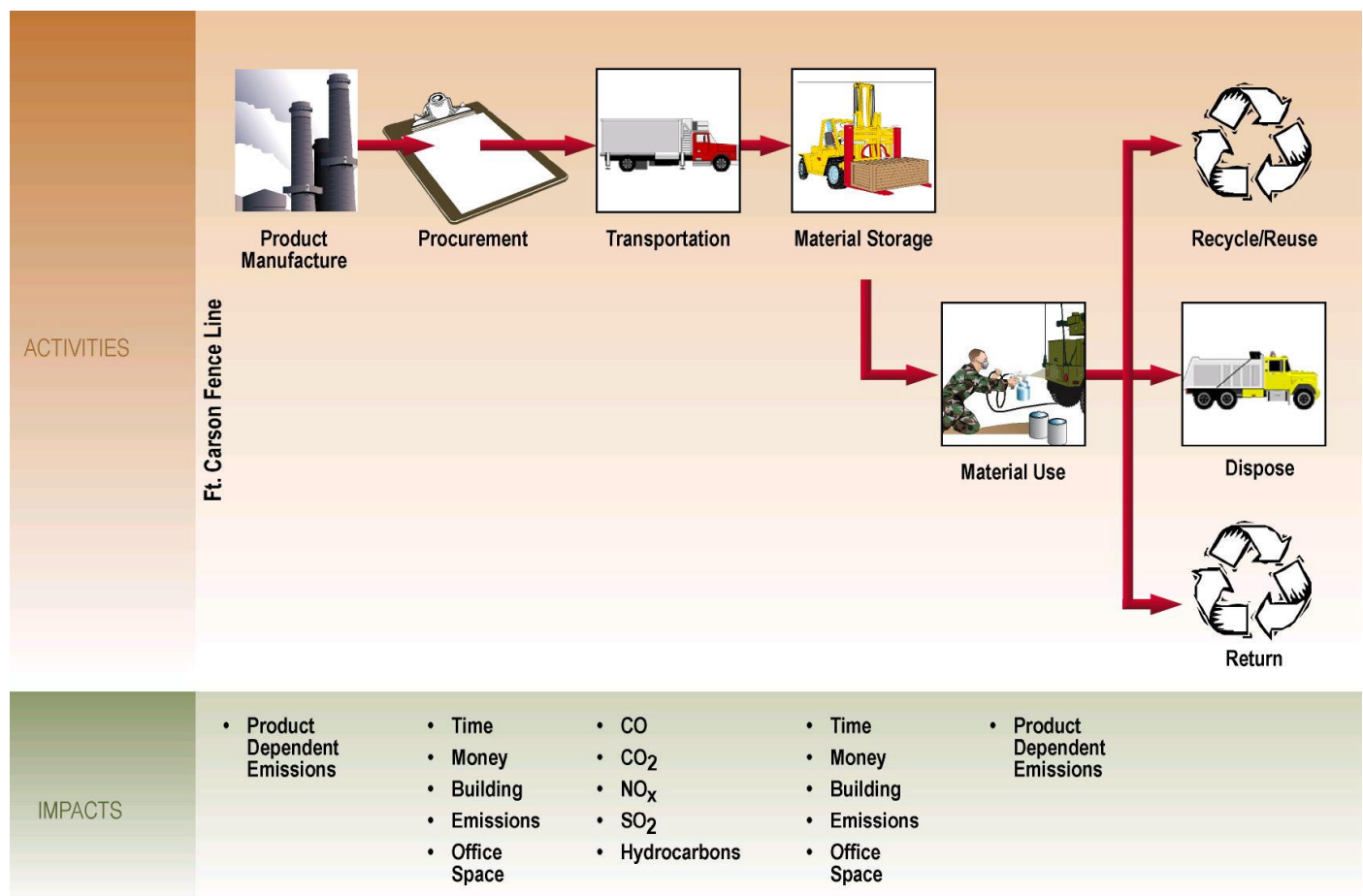


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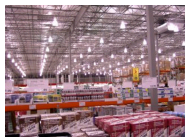
## Activities and Impacts

Figure 6.3 shows the life cycle of products and materials, and the environmental impacts associated with each stage in the life cycle. The buying decisions of Fort Carson consumers and contract officials have the potential to greatly limit environmental impacts and life-cycle costs. However, Fort Carson's current understanding of the environmental and cost impacts associated with product and material use is fragmented. Information on the amount of waste generated exists, as required under various laws, but information about product content and the resources used in production and distribution is lacking. Further, the long-term environmental impacts associated with the use of hazardous and nonhazardous products and materials are largely unknown.

**Figure 6.3 – Product Life Cycle: Activities and Impacts**



The following sections describe the specific environmental impacts associated with the purchase, use, reuse, and disposal of materials.



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### Purchase

The current accounting system at Fort Carson does not readily enable the calculation of resources spent annually on materials, products, and services. There are no data on Fort Carson's purchase of locally manufactured products. Also, Fort Carson has no method for tracking the purchase of materials/products that contain recycled materials.

### Use

Fort Carson tracks and attempts to reduce its use of hazardous materials. The HMCC, established in 1997, serves as the Installation's central hazardous material issuing facility. This facility provides centralized hazardous material ordering, storage, and distribution; issuance to authorized users in quantities limited to immediate needs; tracking of hazardous materials; and collection and reissue of unused, serviceable hazardous material on a free-issue basis. Fort Carson's HMCC was the first in Forces Command to connect its operations to the Standard Army Retail Supply System. The HMCC currently serves 170 installation units/activities; services do not extend to directorates that do not purchase reportable hazardous materials. The only unit not yet inducted is the Army Reserve Maintenance Facility. The primary maintenance contractor for its entomology facility controls the facility's in-house stock of hazardous materials with a special permit. However, the HMCC tracks the entomology facility.

Figure 6.4 summarizes the actual and normalized cost-avoidance statistics due to the activities of the Hazardous Materials Control Center. This cost-avoidance information includes items that were collected by the HMCC and turned into the Defense Reutilization and Marketing Office (DRMO), materials whose lives were extended due to shelf-life management research (proving the product could still be used past its expiration date), and products not disposed of because they were reissued for use by someone else.

### Regulations At A Glance

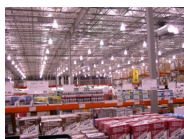
The following environmental regulations and requirements influence the purchase and disposition of materials and wastes at Fort Carson.

**Resource Conservation and Recovery Act (RCRA)** – This federal legislation's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner. RCRA regulates the management of solid waste (e.g., garbage), hazardous waste, and underground storage tanks holding petroleum products or certain chemicals.

**Executive Order (EO) 13101** – *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition* (1998) – This Executive Order requires federal agencies to minimize negative environmental impacts caused by the **whole life cycle** of products, rather than focusing only on better waste management through recycling and reuse programs.

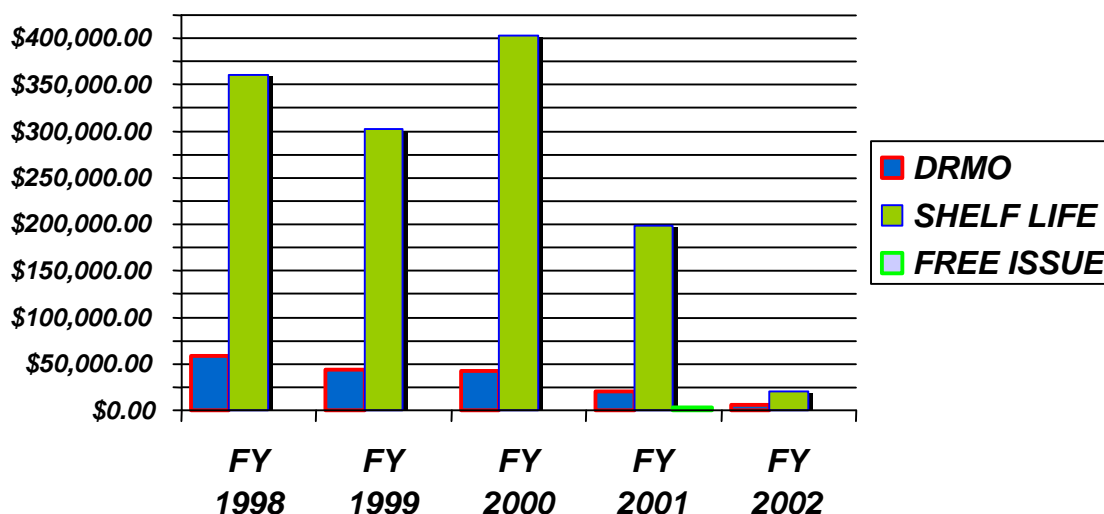
**Emergency Planning and Community Right-to-Know Act (EPCRA)** – This act requires reporting the storage and release of EPA-identified chemicals above threshold quantities.

**Clean Air Act (CAA)** – This federal legislation aims to protect air quality by limiting emissions from stationary and mobile sources. States implement many provisions of the CAA. For example, a state air pollution agency holds a hearing on a permit application by a power or chemical plant or fines a company for violating air pollution limits. In addition, states are responsible for preparing State Implementation Plans that contain strategies for meeting ambient air quality standards.



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**Figure 6.4 – Hazardous Materials Control Center Cost-Avoidance Data**



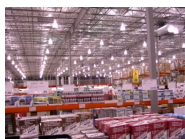
	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	TOTALS
DRMO	\$58,636.20	\$44,118.21	\$42,941.81	\$20,289.12	\$5,367.21	\$171,352.55
SHELF LIFE	\$360,782.78	\$302,409.65	\$403,717.08	\$199,318.41	\$20,540.01	\$1,513,146.93
FREE ISSUE				\$2,712.39	\$138.76	\$2,851.15
<b>TOTAL</b>	<b>\$419,418.98</b>	<b>\$346,527.86</b>	<b>\$446,658.89</b>	<b>\$222,319.92</b>	<b>\$26,045.98</b>	<b>\$1,687,350.63</b>

In addition to controlling the purchase, management, distribution, use, and reuse of hazardous materials, Fort Carson is trying to reduce the consumption of hazardous materials/products through pollution prevention initiatives such as contaminated fuel filtering, solvent recycling, technology changes (e.g., hydrogen peroxide system for ethylene oxide sterilization system), and good housekeeping methods. Fort Carson's declining hazardous material use can be attributed to several factors: increased user awareness, manufacturer responsiveness to reduce hazardous materials in formulations and to improve the "recyclability" of hazardous components, and numerous pollution prevention initiatives that support waste minimization through material management and recycling.

The International Merchant Purchase Authorization Card is a concern in the control of hazardous materials. Unfortunately, by using this credit card, Fort Carson account holders can circumvent the Hazardous Materials Control Center with ease. Even though credit card purchases of hazardous material without HMCC approval before requisition are against Installation policy, some cardholders simply do not call for preauthorization. This is a great concern with regard to reporting, waste, incompatible storage, and control of hazardous materials on the Installation.

### *Reuse*

The Department of Defense (DOD) is one of the original "recyclers" in the nation. Through DRMO, almost every product and material that is no longer needed on a military installation is screened for reuse within



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DOD, if possible. Items that DOD no longer needs are offered for resale to the general public. Through this system, the vast amount of material that Fort Carson no longer needs—office furniture, tires, tents, even scrap metal—is kept out of the solid waste stream and reused by someone else. The success of DRMO significantly limits the environmental impact and cost of waste disposal.

### *Disposal*

When DRMO cannot reuse or sell certain materials, they become solid waste. The term solid waste includes household garbage (also known as municipal solid waste), construction and demolition waste, and hazardous waste (which must be managed separately from the other solid waste). In FY01, Fort Carson generated a total of 306,827 tons of solid waste, including hazardous waste. Recycling, treatment, and energy recovery opportunities allow for the diversion of some hazardous waste from disposal. Landfills result in various environmental impacts including use of open lands, habitat destruction, release of chemicals to the air and water, odor, impact to local species, and various health impacts. Figure 6.5 provides specific information on waste generated at Fort Carson.

**Figure 6.5 – Waste Generation and Management Data (FY01)**

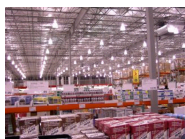
Type	Amount (tons)	Amount (cubic yards)	Disposal Cost (\$)
Construction and Demolition	295,222	679,012	Totaled with Sludge
Contaminated Soils	1,636	3,762	Totaled with Sludge
Sludge	1,009	2,321	\$66,786
Hazardous Waste	25	n/a	\$60,000
Refuse Collection and Disposal	8,935	28,591	\$386,681
Total	306,827	713,686	\$513,467

**Municipal Solid Waste (MSW)** – Solid waste generated from activities at Fort Carson historically has been landfilled on site. The Installation has closed nine landfills dating from the 1940s through the 1970s. Until it stopped receiving waste April 1, 2002, Landfill 1 (used to dispose of construction debris, sludge, and contaminated soils) was the only remaining landfill in use on the installation. All municipal solid waste must now be taken to a landfill off site, incurring much greater costs than on-site disposal. With no signs of decreasing amounts of debris, a large budget for solid waste is a necessity.

In the past, Fort Carson has operated an award-winning recycle operation for paper, plastics, metals, cardboard, glass, and other items as needed. Currently, the market for recycled goods has declined enough to make the recycling of brass and other metals the only profitable operations. The recycle center still accepts plastic, metal, and paper, but does not generate a profit from those items. The amount of diverted recycled materials is not currently tracked. No composting program for yard trimmings, land-clearing debris, or food waste is in place.

**Military-Specific Waste** – Fort Carson generates a variety of military wastes that may be disposed of as solid waste. In several cases, disposal has been avoided by recycling or reusing military training wastes.





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Brass from munitions is profitable enough to justify the purchase of a brass deformer. This system, which brings a higher price for the brass, ensures that the munitions will not explode again. A recent innovative pollution-prevention project redirected over two million pounds of tank track from a landfill to stabilize slopes and for hardened water crossings on Fort Carson and around the Pikes Peak region. Tank track continues to be recycled for slope stabilization, rather than disposed of in a landfill (Figure 6.6).

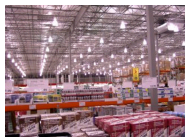
**Figure 6.6 – Use of Tank Track for Slope Stabilization Hardened Water Crossing**



Although Fort Carson owns a fuel filtration system at the Hazardous Waste Staging Site, contaminated fuels continue to be shipped off site or diverted into the convaults used for the Re-Refined Oil Program. This diversion does not contaminate the used oils stored in the convaults, but it does add to an imbalance in the program, creating more material taken by the vendor than can be purchased back by the Installation.

Lithium batteries, which are lightweight and long lasting, are used in military radios. Unfortunately, when a battery's life is uncertain, it is disposed of in the trash. The batteries should be tested and returned before venting and disposed of as solid waste. Because Fort Carson does not own a testing system, 978 pounds of batteries (including nickel cadmium, nickel metal hydride, and mercury) were disposed of as hazardous waste in 2001. The Hazardous Waste Manager is attempting to purchase a testing system for the Pollution Prevention Center. Rechargeable nickel metal hydride batteries were tested at Fort Polk and determined to be too heavy for combat situations.

**Hazardous Waste** – The primary industrial operation on Fort Carson is repair and maintenance of vehicles and aircraft. This activity requires the use of degreasers, solvents, petroleum products, paint, and numerous other materials. Routine oil changes, vehicle cleaning, painting, refueling, battery repair and replacement, radiator servicing, brake repair, tune-ups, parts machining, and engine rebuilding require the use of many hazardous materials. Figure 6.7 lists hazardous materials disposed of on the Installation in 2001.

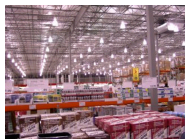


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**Figure 6.7 – Hazardous Waste Processed in 2001**

General Waste Type	Pounds	Remarks
Landfill remediation analysis byproducts	13,299	Mostly lead, chromium, and selenium from purge wells.
Methyl ethyl ketone (paint thinner)	9,338	MEK can cause central nervous system damage and is flammable.
Paint and paint waste	8,399	Latex (1965 lbs), paint products (727 lbs), CARC and enamel (5707 lbs).
PCB ballast	8,370	Part of the PCB replacement program.
Silver from photography	7,652	Silver is recycled as a precious metal.
Blast media	7,560	Includes cadmium and chromium from CARC paint.
Fluorescent bulbs	7,058	All will be managed as Universal Waste in 2002.
Petroleum/oil/lubricant products	6,324	Includes corrosion prevention, contaminated fuels, grease, etc.
Solvents	5,158	Includes heptanes, chromium compounds, stoddard solvent, and toluene.
Cadmium and lead from smoke pots	3,313	For training activities.
Acetone	2,207	Primer; also found in contaminated fuels.
Fire protection supplies	2,200	Foam from fire extinguishers; lead and benzene from water sludge.
Warfare equipment	1,983	Gas mask filters with chromium and lead; super tropical bleach for decontamination.
Toluene and toluene compounds	1,267	Contaminated liquids.
Batteries	978	Universal Waste: NiCad, NiMH, Lithium, Mercury.
General cleaning	733	Floor polish remover, detergent, floor wax, etc.
Unknown	704	
Asphalt	454	
Adhesives	443	
Miscellaneous	367	Soldering flux, gasket remover spray, fingerprint remover, cutting fluid, etc.
Pesticides	347	This amount is larger than normal due to excess cleanup.
Acid	308	Chromic, perchloric, phosphoric, sulfuric, boric, citric, nitric, etc.
Aerosols	304	Varnish, lubricant, cleaners.
Medical	2,961	Xylene, potassium hydroxide, dental resin, hydroquinone, chloroform, etc. Approximately 2000 pounds of ethanol, alcohol, and xylene will be recycled in 2002.
Leftover kit items	238	Mostly mercury and cyanide from chemical detection kits.
Mercury from inside equipment	159	
Sealant	141	
Degreaser	104	
Freon	55	
Lab waste	10	

Fluorescent bulbs, some batteries, methanol, alcohol, xylene, silver, and many solvents are now recycled or sent as Universal Waste. Aerosol paints are vented and the cans recycled.



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The DRMO at Fort Carson accepts hazardous materials from all other area military installations. If this material does not sell, expires, and becomes hazardous waste, Fort Carson must dispose of it and count it toward the total hazardous waste disposed of by the Installation.

Below is a discussion on the environmental impacts to air and water quality resulting from activities associated with products and materials.

### *Air Emissions*

Purchasing and disposal methods for materials have a tremendous impact on air quality. Vehicle air emissions are associated with transporting products to the Installation and hauling waste off post. The storage and use of hazardous materials result in the release of pollutants to the air, which can contribute to local and regional air pollution. Some pollutants degrade stratospheric ozone. While air emissions are addressed in detail in the Air Quality section of this baseline document, it is important to understand the link between material purchase/use and air pollutant emissions.

### *Water Quality*

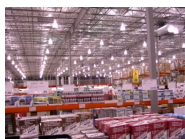
A variety of products and materials contaminate water supplies. Water and solvents/soaps are used to clean vehicles, facilities, and equipment (e.g., paint guns). Water runs over the surface of the ground and picks up metals, organic compounds, oil, fuel, dirt, etc. Hazardous materials spilled into drains or streams contaminate surface water and groundwater. The chemical stew called “leachate” that is released when solid waste landfills leak—most eventually do—also contaminates water. Therefore, the products purchased and their associated disposal method have serious impacts on water quality. The Water section of this baseline document goes into more detail about the water-related issues facing Fort Carson.

### **The Human Perspective**

Soldiers are concerned about the environment, and most are proactive in minimizing environmental damage. Most are aware of environmental laws and are careful with the products they use. With soldiers' input and consideration, the Directorate of Environmental Compliance and Management recommends new methods for pollution reduction and purchase reductions. The best way to get soldiers (or anyone) to use new products is to show them why the new products are better for them—from a health or cost perspective, for legal reasons, or simply to provide the legacy of a clean environment for their children.

### **Beyond the Pikes Peak Region**

Environmental impact increases when materials are purchased from nonlocal vendors. Long-distance transport of products is accompanied by greater emission of carbon monoxide, carbon dioxide, nitrogen oxides, sulfur dioxide, hydrocarbon products, and other damaging substances. The Pikes Peak region has many local manufacturers of the goods used at Fort Carson (Figure 6.8). Use of these goods not only helps preserve the environment, but also stimulates the local economy.



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**Figure 6.8 – Sample List of Local Companies in the Pikes Peak Region**

Company	Type of Business	Employees
Hewlett-Packard	Computers and data communications equipment	1,550
Current, Inc.	Mail order catalog sales; stationery; paper products	1,456
Schalge Lock Co.	Lock and door hardware	1,000
Western Forge Co.	Hand tools	996
Trane Co.	Heating, ventilation and air conditioning equipment	950
SCI Systems, Inc.	Computer parts manufacturer	928
Rocky Mountain Steel	Structural steel products	825
Mission Foods	Food products	300
B.F. Goodrich	Tires and rubber products	246

More comprehensive lists can be purchased for \$10 to \$80 by visiting the following links:

- <http://mnistore.com/products.asp?STATE=CO>
- <http://www.amazon.com/exec/obidos/ISBN%3D0894781081/107-9845567-7986914>

### Forecast

Since the inception of the Hazardous Materials Control Center, the stockpiling of hazardous materials has decreased somewhat. The free issue of obsolete hazardous materials has reduced some purchases. However, a more comprehensive approach to the control of hazardous materials is warranted. Due to limited staff, visits by technicians to hazardous materials storage centers are few; thus, stockpiling may occur after a unit has been inducted into the Hazardous Materials Control Center. The use of International Purchase Authorization Cards enables the purchase of hazardous materials not accounted for in the tracking system. Even though circumvention of the HMCC is against Installation rules, Environmental Assistance Technicians have detected such activity.

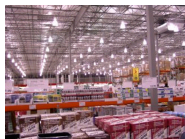
Hazardous waste disposal is decreasing, although the limits to this reduction may be reached soon. Through better training, pollution prevention techniques, and regular inspections, disposal of hazardous waste has decreased dramatically over the past seven years (Figure 6.2). Fort Carson hazardous waste and pollution prevention personnel continually search for ways to reduce the amount of hazardous waste generated.

The Affirmative Procurement Plan is in progress and should make great strides toward creating markets for recyclables, encouraging more environmentally friendly manufacturing, and discouraging the use of nonrenewable resources. The Directorate of Contracting is writing the Plan in partnership with the Directorate of Environmental Compliance and Management; thus, the people who can significantly contribute to the success of the program are participating in Plan development. As the largest spender in the nation, the Federal Government should be the first to excel in the area of Affirmative Procurement.

### Current Sustainability Activities

**Re-refined Oil Program** – The Directorate of Logistics has been in charge of the re-refined oil program at Fort Carson since 1998. Used oil is placed in convaults and picked up by Safety Kleen, which re-refines the oil and sells re-refined oil back to the Installation.





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**Hydrogen Peroxide Sterilization System** – The Directorate of Environmental Compliance and Management replaced the ethylene oxide sterilization system at Evans Army Community Hospital. (Ethylene oxide is a carcinogen and upper respiratory irritant.) The new system uses low-temperature hydrogen peroxide gas plasma technology to sterilize equipment, and generates water vapor and oxygen as byproducts.

**Alcohol and Xylene Recycling** – The hospital uses a distillation system to recycle xylene and alcohol. The system saves money and reduces the purchase, transportation, and disposal of these hazardous substances.

**Fuel Filtration System** – When fuel is contaminated with water or dirt, it is no longer useable, especially for tactical or flying vehicles. The fuel filtration system at the Hazardous Waste Staging Facility provides recycled fuel for forklifts and other nonmission-essential ground vehicles.

**Installation Design Guide** – The Installation Design Guide recommends that local vendors and other environmentally preferable practices be used when building anything at Fort Carson.

**Building Design Reviews** – The Directorate of Environmental Compliance and Management reviews all building designs to make recommendations on environmentally friendly building practices, such as requiring construction companies to build in ways that reduce the amount of materials used and waste generated.

**Fluorescent Bulb Crushing** – The Hazardous Waste Staging Facility crushes fluorescent bulbs (after filtering for mercury and other hazardous materials) and sends the resultant glass and metal to be recycled.

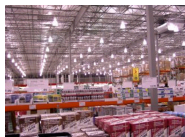
**Aerosol Can Recycling** – A special system at the Pollution Prevention Center punctures collected aerosol cans. The empty cans are then recycled and the remaining paint is sent out as waste.

**Solargizers** – Several vehicles at Fort Carson use solargizers. Charged by the sun, this equipment extends the life of batteries one to five years by preventing sulfate deposit buildup. (Sulfates are returned back to the battery acid as active electrolyte.)

### The Realm of Possibility

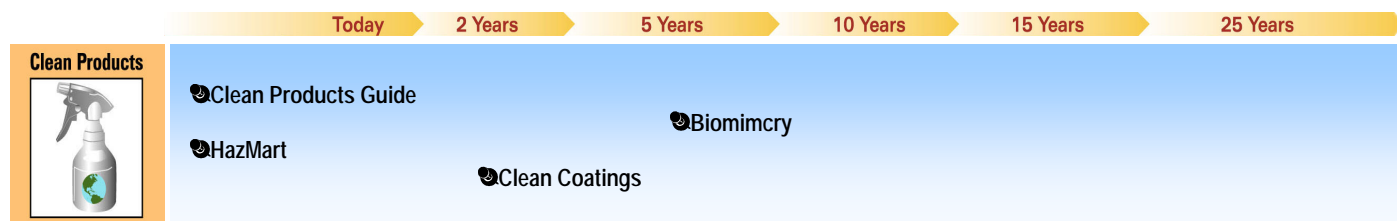
To become sustainable, Fort Carson is encouraged to identify and plan for innovations that will support the goals established during the Installation Sustainability Workshop. To do this, participants should be exposed to the concepts and technologies that are within the realm of possibility now and in the future. This section provides a glimpse of what can be accomplished with existing technology and what can be expected from developing sustainability approaches.



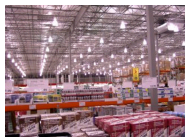


# MATERIALS

## Clean Products

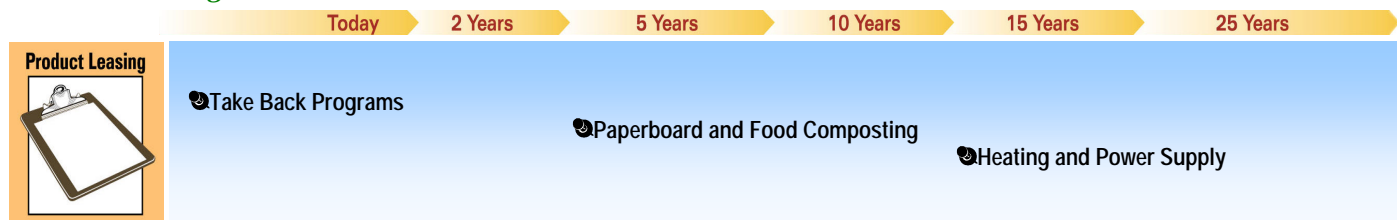


- **Clean Products Guide** – GSA maintains an extensive “Environmental Products and Services Guide” which lists all available “green” products. The guide can be found on the following websites: [http://www.gsa.gov/attachments/GSA\\_PUBLICATIONS/pub/EPSPG2001.pdf](http://www.gsa.gov/attachments/GSA_PUBLICATIONS/pub/EPSPG2001.pdf)  
<http://pub.fss.gsa.gov/environ>
- **HazMart** – Hazardous material pharmacies help control the use of environmentally harmful materials by tracking the purchase and disposal of products in one central location. In this system, a worker who needs a certain chemical must “check-out” the substance from the central location and return the unused portion. This ensures that harmful chemicals are not improperly disposed of, and can save money by making sure that all purchases are of the correct amount for the required use.
- **Clean Coatings** – Researchers have developed alternative paint technologies to assist in reducing energy consumption for heating and cooling facilities. Thermal Diode Ceramic Coatings facilitate thermal control of buildings or other structures and components by creating a barrier between the external environment and the surface to which it is applied. The coating acts like a heat insulator in one direction and a conductor in the other; thus, keeping heat where it is needed and allowing its dissipation from the opposite side (Thermal Diode Publication by 27th Century Technologies, Inc.).
- **Biomimicry** – Biomimicry stems from the belief that the future of material design and use can be found in the design of the natural world around us. Abundant evidence indicates that nature has long ago mastered the problems that we still grapple with today. The silk from a spider’s web is *three times* stronger than Kevlar, the material used in bulletproof vests. Slug mucous can withstand pressure up to 1500 times its weight without losing any of its fluid or lubricating properties. Termite mounds are marvels of design ingenuity, using passive cooling systems and venting to maintain constant interior temperatures regardless of exterior temperatures. See this web site for more information: <http://www.natick.army.mil/warrior/97/nov/silk.htm>.

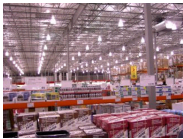


# MATERIALS

## Product Leasing

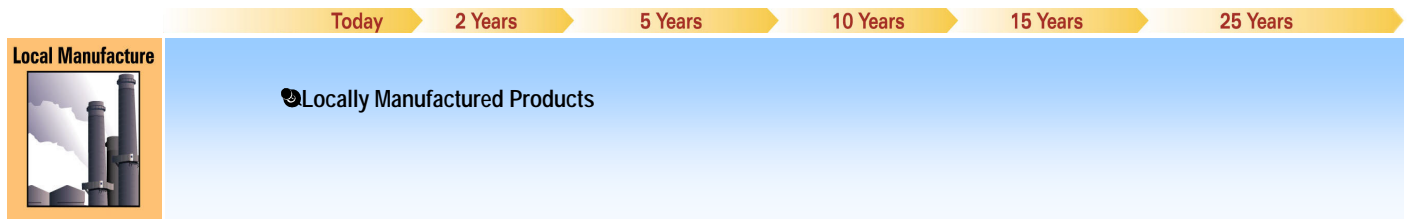


- **Take Back Programs** – One of the new business models taking hold in Europe and Asia is “manufacturer take back” programs. In such a program, the original manufacturer retains ownership and disposal responsibility for products. BMW automobiles are being built to be completely recyclable into new BMWs, as are Nike shoes. Interface, Inc. is the American manufacturer pioneering this concept. Interface’s “Evergreen Lease” on commercial carpet provides a service in which worn carpet tiles are checked and replaced each month. The worn tiles are taken back and recycled 100 percent into new carpet. This business model is not new—think back to when the telephone company owned your old black phone, which never broke or had to be replaced. For more information on efforts world-wide, see Chapter 3, *Waste Not*, and Chapter 4, *Making the World*, in the book Natural Capitalism.
- **Paperboard and Food Composting** – Shredded paperboard can be used as a bulking agent for food composting. A food composting program, which may include preconsumer (i.e., kitchen waste) and/or post-consumer (e.g., food service waste from lunchrooms) waste, typically needs a bulking agent to absorb the excess water from food waste. Compost is a useable product that can be generated from such a venture.
- **Heating and Power Supply** – Today, almost every home and business owns a hot water heater and heating, ventilation, and air conditioning (HVAC) unit. When these units fall out of service or need to be replaced, they are almost always disposed of in a local landfill. There is an alternative; Trane is starting to offer full-service leases to commercial clients at competitive monthly rates. In these arrangements, the customer provides the location for installation and Trane takes care of the rest. When the customer desires a new unit, the old unit is returned to the manufacturer and a new one is provided. In the future, home heating and electricity may be bundled in a fuel cell, further simplifying the process (<http://www.trane.com/commercial/financing/leasing.asp>).



# MATERIALS

## Local Manufacture

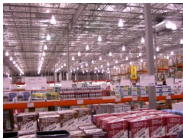


- **Locally Manufactured Products** – The use of locally manufactured products reduces harmful air emissions by reducing the distance those products must be transported to their final destination. In addition, the purchase of these products stimulates local economies, providing more vital communities around the installation.

## Use Reduction

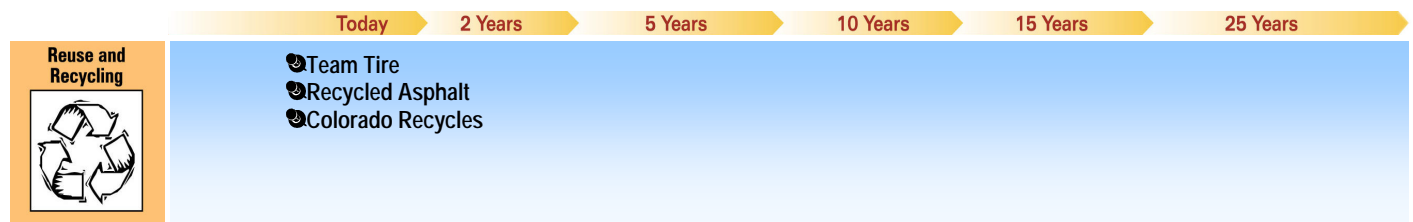


- **Laser Cleaning Technology** – Laser cleaning technology is being researched for possible application in maintaining military weapon systems and facility maintenance. Techniques for using laser cleaning on building materials have been standardized by companies that developed lasers for restoring historical buildings and artifacts. Laser cleaning technology eliminates the use of chemical paint strippers and reduces hazardous waste created during abrasive blasting. This technology has been used in other industries (e.g., automotive, mold release) for cleaning applications, reducing or eliminating the use of chemical cleaning compounds. With portable laser units, production time can be reduced due to the elimination of disassembly and assembly of the weapon system or facility components for maintenance. See these web sites for more information:  
[http://www.jgpp.com/projects/projects\\_index.html](http://www.jgpp.com/projects/projects_index.html)  
<http://www.lynton.co.uk/conservation/framesetversion/frameset.htm>
- **Two-sided Copying and Printing** – Printing and copying on both sides of a sheet of paper is a fast and easy way to immediately reduce paper use by 50 percent. Printers can be used with little or no modification and overall printing speed is preserved.
- **Totally Electronic Offices** – In the next 10 years, offices will use less and less paper as workers become more dependent upon email, web pages, and other electronic means of doing business. This will reduce the overall flow of material into an office, and there will be fewer pens, staplers, tape, and plastic binders as well.
- **E-paper** – Lucent Technologies and E Ink Corp of Cambridge, Massachusetts, are developing e-paper. This paper may be used repeatedly to download daily newspapers and books.



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## Reuse and Recycling

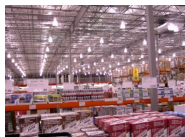


- **Team Tire** – Several Department of Defense (DOD) and Army agencies and installations participate in the Army Tank-automotive and Armaments Command's (TACOM) “Team Tire” Program, in which vendors provide motor pools with retreaded tires in exchange for used tires. The used tires are retread by the vendor for reuse elsewhere. The cost of retread tires is significantly less than that of new tires—up to \$200 less for certain tires.
- **Recycled Asphalt** – DOD and the U.S. Environmental Protection Agency (USEPA) conducted a joint parking lot repaving project for the Pentagon. The \$1M project used 25 percent recycled asphalt.
- **Colorado Recycles** – The Denver Post publishes a yearly guide to recycling in Colorado. The phone number for Colorado Recycles is 303-231-9972.

## Waste



- **Landfill Fluff** – Fort Campbell and the Army's Construction Engineering Research Lab are testing a new waste-reduction technology in partnership with its inventor, Bouldin-Lawson, Inc. Unsorted household garbage is fed into a grinder, hydrolyzed, and then flash-heated to kill germs. The resulting dry “fluff,” which looks like cellulose insulation and contains many nutrients, has passed all toxicity tests and appears to pose no environmental hazard. The process reduces waste volume and weight by 90 percent. The entire process costs \$30/ton—comparable to landfill disposal fees in most areas of the country. Testing at Fort Campbell will determine if the “fluff” is useful as a soil amendment and if it can be extruded into building materials (i.e., plastic lumber). If beneficial reuse for the “fluff” can be found, this technology has the potential to eliminate the need for landfilling household garbage.
- **Innovative Deconstruction** – Fort Knox sells the salvage rights to buildings that are on the demolition schedule. The purchaser of the rights can remove windows, doors, flooring, siding, plumbing, and copper wire, but must remove at least 50 percent of the volume of the building. The



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installation makes about \$100K/year on the sale of the salvage rights, but saves hundreds of thousands of dollars on reduced demolition and disposal costs. Fort McCoy has a similar program.

Redstone Arsenal has paid a local house mover and developer to move 89 two-story brick duplexes off the installation and into the local community, where they will be sold and reused. The cost was about \$9,000/house versus the \$12,000 it would have cost to demolish them—a total cost savings of \$267,000.

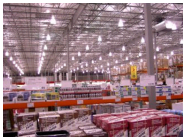
The Army has signed a Memorandum of Agreement with Habitat for Humanity to allow Habitat to deconstruct buildings on the demolition schedule and sell the salvaged items to support Habitat home-building activities. A pilot project is being developed at Fort Hood with the Austin, Texas Habitat affiliate.

Researchers at the Georgia Institute of Technology are studying how to construct buildings so that they can be easily deconstructed and the building materials reused.

The Air Force has a pocket guide for construction and demolition waste management that is available at <http://www.afcee.brooks.af.mil/gree/resources/resources.asp>.

- **Zero Footprint Camp** – The U.S. Army Materiel Command (AMC) recognizes that traditional waste management methods used for base camp operations are resource-intensive and create a substantial burden on the camps. These traditional methods also depend on contracted civilian waste management services, posing potential risk to the physical security of the area from terrorist activities. In response to these concerns, AMC developed the Zero Footprint Camp (ZFC) initiative to reduce the logistics footprint, operations and support costs, and environmental impacts of base camp operations. This initiative minimizes waste by applying “whole-systems” approaches to resource management, thereby finding cost-effective and technically feasible ways to reprocess and/or reutilize trash, grey water, black water, and food garbage within the camp. While the current ZFC initiative focuses primarily on solid waste and wastewater management, it will be expanded to cover other aspects of base camp operations. See <http://www.haifire.com/download/zfc.pdf>.
- **Thermal Spray Vitrification** – An alternative method for removing lead-based paint is thermal spray vitrification. In this method, a specially formulated glass medium is flame sprayed onto the painted surface. Any lead in the paint is absorbed by the glass. After a post-removal heat treatment, the removed paint and used glass medium is reduced to benign waste. This technology allows for the safe removal of lead-based paint and a reduction in the disposal of hazardous waste (<http://estcp.hgl.com/projects/compliance/199607v.cfm>).
- **Combined HazMart** – Fort Campbell, Kentucky, shares resources between the Environmental Division and the Directorate of Logistics to provide the best Hazardous Materials Control Center service in the Army. The technicians go to the motor pools and stock materials, remove empty containers, conduct an environmental inspection, change out solvent tanks for recycling, and perform Pollution Prevention Opportunity Assessments. This service increases readiness and saves money.



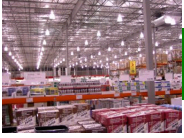


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- **Model Motor Pool** – Fort Lewis is experimenting with a “Model Motor Pool,” where several low-cost and high-cost pollution prevention methods and pieces of equipment are used. They collect as many fluids as possible for recycling and implement practices that prevent spills and excessive use of materials.

### Fort Carson 25-Year Goals for Materials

To be determined by Fort Carson Command and staff, as advised by members of the local and regulatory communities, at the Installation Sustainability Workshop on 4-6 September 2002.



## MATERIALS

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